REMARKS

Claims 1-4,9, and 20 are pending in this application. Claims 1-4 and 9 are rejected; and claim 20 is allowed in this application.

Responsive to the rejection of claims 1-4 and 9 under 35 USC § 103 (a) as being unpatentable over U.S. Patent Number 4,795,582 (Ohmi et al), Applicants hereby submit a signed declaration filed under 37 CFR § 1.132 which includes further data provided by the inventors (labeled as Tables A-C) and hereby otherwise respectfully traverse this rejection. Applicants submit that claims 1-4 and 9 are now in condition for allowance.

Claim 1 recites, in part:

> [a] micromachining surface treatment material containing less than 0.1% hydrofluoric acid, and more than 40% by weight, but less than or equal to 47% by weight of ammonium fluoride.

Applicants submit that such an invention is neither taught, disclosed, nor suggested by Ohmi et al '582 or any of the other cited references, alone or in combination.

Ohmi et al discloses the use of a hydrofluoric acid concentration of 0.1 to 10% by weight and an ammonium fluoride concentration of 15 to 40% by weight. Ohmi et al fails to teach or suggest using both a hydrofluoric acid concentration of less than 0.1% and an ammonium fluoride concentration of greater than 40%. Furthermore, the reference fails to provide any suggestion as to why it would be advantageous to use a hydrofluoric acid concentration lower than that suggested and simultaneously using an ammonium fluoride concentration greater than that proscribed.

The Examiner instead contends that the prior art range is close enough so that one of ordinary skill in the art would have expected concentrations just outside this claimed range to have produced similar properties. The Examiner also contends that concentration and composition are commonly determined by routine experimentation and that the process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. However, the Examiner has failed to consider that Ohmi et al '582 does not disclose what effects should be expected by varying the concentration of both the hydrofluoric acid and the ammonium fluoride concentrations. As set forth in MPEP 2144.05 (II) (B), a particular parameter must be first recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of that variable might be characterized as routine experimentation. Since Ohmi et al '582 does not disclose or suggest what, if any, result is to be achieved by varying solely the ammonium fluoride concentration, solely the hydrofluoric acid concentration, or both such concentrations, the determination of the optimum or workable ranges of such concentrations cannot be characterized as routine experimentation.

Additionally, the arguments set forth by the Examiner are all essentially based upon case law. Yet, as per MPEP § 2144.04, if Applicants have demonstrated the criticality of a specific limitation, it would not be appropriate to rely solely on case law as a rational to support an obviousness rejection. Applicants submit that having both an ammonium fluoride concentration higher than 40% and a hydrofluoric acid concentration

lower than 0.1%, as set forth in the attached rule 132 declaration, is critical to the invention.

Specifically, a high concentration of ammonium fluoride slows the etching rate of a CVD film or TEOS film and has sufficient performance with respect to removing a natural oxidation film (page 6 of the specification, lines 11-17). From the discussion on pages 12-15 of the specification with respect to Tables 1-4, the use of etchants with a combined HF concentration of less than or equal to 0.1% and an NH_4F concentration in excess of 40% by weight tend to produce etching rates in thermal oxidation, PL-TEOS, and TEOS-BPSG that are close to the etchant rates produced by those etchants in a natural oxidation film. Furthermore, such etching concentrations also tend to suppress the widening of contact holes formed in such films, thereby allowing holes of a design diameter to be obtained.

Tables A and B, provided as part of the attached Rule 132 Declaration, show additional etching rate and hole size data, respectively, which further support the data in originally submitted Tables 1-4. Meanwhile, Table C displays the data given in Table A in yet another format. Specifically, the difference in etch rate produced by a given etchant in a natural oxidation film as opposed to each of a thermal oxidation film and a PL-TEOS film is provided. As seen from Table C, these etch rate differences are all at their lowest (i.e., closest to the etching rate for a natural oxide film) when the HF and NH_4F concentrations are within the range set forth in claim 1. For example, in examining the etch rate differences for natural versus thermal oxidation, the lowest differential for an

etchant outside the claimed range is 8.3 nm/min while the highest such difference for an etchant that falls within the claimed range is 6.7 nm/min. As for natural oxidation relative to PL-TEOS, the highest differential associated with an etchant that falls within the claimed range is 4.5 nm/min, while the lowest such difference for an etchant falling outside the claimed range is 5.5 nm/min.

Thus, with the data presented in Tables 1-4 and A-C, Applicants have sufficiently established the criticality of the limitations on the etching concentration set forth in claim 1. The criticality is not merely established by any one group of the tabulated test results alone but by the combination of the various test results presented. It is the trend (i.e., the critical nature of 0.1% HF/40% NH_4F) common to the groups of test results that fully substantiates the criticality and unexepected nature of the present invention.

Moreover, it is clear that Ohmi et al '582 is not directed to the issue of how the etchant concentrations of HF and NH_4F can be adjusted to both create more uniform etching rates in various types of oxide films and suppress the widening of contact holes formed in such oxide films. In other words, Ohmi et al '582 does not provide a solution to the set of problems addressed by the present invention. Ohmi et al '582 simply does not suggest any potential benefit to be gained by using etchants with HF and NH_4F concentrations in the ranges set forth in claim 1.

Applicants further hereby incorporate the arguments from our previous response mailed August 15, 2002, set forth with respect to the rejection of claims 1-4 and 9 based

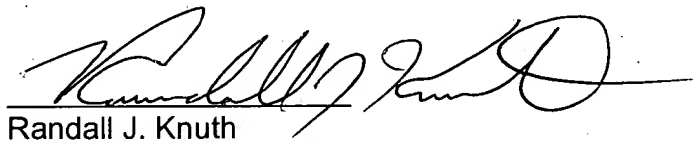
upon Ohmi et al '582. Applicants submit that those arguments are still valid and pertinent to the present rejection.

For all the foregoing reasons, Ohmi et al fails to teach the present invention as set forth in claim 1. Accordingly, Applicants submit that claim 1, and claims 2-4 and 9 depending therefrom, are now in condition for allowance and hereby respectfully request that the rejection thereof based upon Ohmi et al be withdrawn.

Claim 20 has been allowed by the Examiner, for which courtesy the Examiner is thanked.

If the Examiner has any questions or comments that would speed prosecution of this case, the Examiner is invited to call the undersigned at 260/485-6001.

Respectfully submitted,



Randall J. Knuth
Registration No. 34,644

RJK/mdc10
Encs: Declaration Under 37 CFR § 1.132
Including Tables A-C
Explanatory Cover Sheet Page 1
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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450, on: November 5, 2003.

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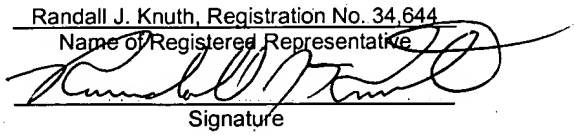

Signature

November 5, 2003
Date

Customer No. 022855
RANDALL J. KNUTH, P.C.
3510-A Stellhorn Road
Fort Wayne, IN 46815-4631
Telephone: 260/485-6001
Facsimile: 260/486-2794

(Table A)

chemical		etch rate (nm/min) at 25°C		
HF	NH_4F	thermal oxide	PL-TEOS	natural
0.5	39.6	9.0	15.0	45.0
0.25	39.8	5.1	9.0	28.0
0.12	41.0	3.0	6.0	13.0
0.11	41.0	3.0	6.0	12.5
0.10	41.0	2.8	4.5	9.0
0.09	44.0	2.2	4.5	7.0
0.09	41.0	2.3	7.5	8.0
0.09	40.01	2.5	8.5	9.2
0.09	39.9	2.7	5.5	11.0
0.09	17.0	2.6	9.5	36.0
0.07	41.0	2.5	5.4	6.9
0.03	45.0*	2.0	3.0	6.0
0.001	45.0*	0.2	0.5	1.0

(Table B)

chemical		contact hole size (μm)		
HF	NH_4F	initial	PL-TEOS	O_3-TEOS
0.5	39.6	1.0	1.02	1.09
0.25	39.8	1.0	1.02	1.05
0.12	41.0	1.0	1.01	1.02
0.10	41.0	1.0	1.01	1.01
0.09	39.9	1.0	1.01	1.02
0.09	17.0	1.0	1.02	1.07
0.09	41.0	1.0	1.00	1.01
0.03	42.0	1.0	1.00	1.00
0.001	45.0	1.0	1.00	1.00

(Table C)

chemical		etch rate difference (nm/min) at 25°C	
HF	NH_4F	(natural) - (thermal oxide)	(natural) - (PL-TEOS)
0.5	39.6	36.0	30.0
0.25	39.8	22.9	19.0
0.12	41.0	10.0	7.0
0.11	41.0	9.5	6.5
0.10	41.0	6.2	4.5
0.09	44.0	4.8	2.5
0.09	41.0	5.7	0.5
0.09	40.01	6.7	0.7
0.09	39.9	8.3	5.5
0.09	17.0	33.4	27.5
0.07	41.0	4.4	1.5
0.03	45.0*	4.0	3.0
0.001	45.0*	0.8	0.5